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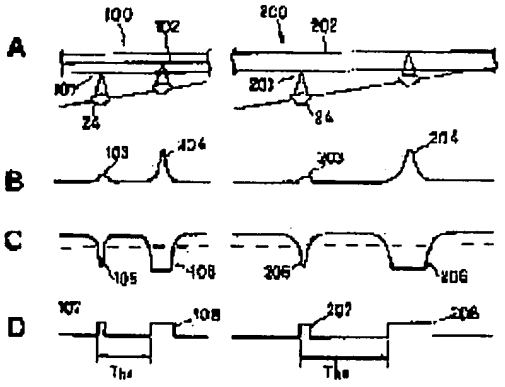
(54) OPTICAL DISK DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To always discriminate correctly a kind of a loaded optical disk, e.g. whether the optical disk is a CD or a DVD.

SOLUTION: In the case of loading, e.g. a DVD 100, a time difference Ths between a pulse 107 resulting from a peak 103 caused by surface reflection and a pulse 108 resulting from a peak 104 caused by reflection on a signal side in a signal binarizing a sum signal based on a reflected light is measured. Furthermore, a time difference Tfs between pulses 111, 112 based on S-shaped signals resulting from reflection on the signal side in a signal binarizing a focus error signal is measured. A ratio Ths/Tfs is calculated from the measured values. Similarly to the case above, a ratio Ths/Tfs of a CD 200 is calculated. Since the ratio Ths/Tfs denotes it that the effect of dispersion in the sensitivity in a focus direction of an actuator moving an objective lens 24 is eliminated based on the time Ths reflecting a thickness of a substrate of the optical disk, a type of the optical disk is correctly discriminated based on the ratio Ths/Tfs.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] this invention -- for example, CD (Compact disc) DVD (Digital Versatile Disk) etc. -- it is related with the optical disk unit which has the function which records and/or plays two or more kinds of optical disks.
[0002]
[Description of the Prior Art] In recent years, an optical disk unit is asked for the function which records and/or plays the optical disk with which record formats etc. differ in many cases. For example, in CD and DVD, the coding approaches differ first. That is, with DVD, the 8-16 coding approach is used to the 8-14 coding approach being used in CD. Moreover, in DVD, it is 0.44 micrometers to the shortest truck pit length being 0.834 micrometers in CD.
[0003] Furthermore, in DVD, it is 0.8 micrometers to a track pitch being 1.6 micrometers in CD. In addition to the difference in the configuration of such a record pit, it originates in generally a data compression being performed to the signal recorded on DVD in many cases etc., and let DVD be what has a large data-logging consistency compared with CD.
[0004] For this reason, the equipment which reproduces both CD/DVD is made as [have / one optical pickup which has two optical pickups as the object for CD, and an object for DVD, or was made as / change / optical system, a regenerative-signal output system, etc. / according to any of CD/DVD the objects for playback are]. Moreover, single optical system is used and the optical pickup made as [acquire / in a certain amount of precision / from all of CD/DVD / a regenerative signal] is also used.
[0005] On the other hand, since it differs as existence, a data-logging consistency, etc. of the coding approach and a data compression mentioned above, setting out of the signal-processing system concerning playback etc. needs to change the data based on the output of an optical pickup according to any of CD/DVD the objects for playback are. Moreover, CD-R (CD-Recordable) Recordable optical disks, such as DVD-R (DVD-Recordable), are also used. In such an optical disk, it is necessary to double with an optical disk also about setting out of the signal-processing system concerning record etc.
[0006] By the way, it is the lamination disk made as [have / on appearance / ****** with a dummy with a thickness of 0.6mm etc. and / DVD has 0.6mm substrate thickness to CD and DVD being veneer disks with which CD has 1.2mm substrate thickness, although each diameter is 12cm and board thickness is also 1.2mm, and / the thickness of 1.2mm]. Both form a pit side on a disk substrate using the stamper (metal mold) formed based on recording information, have the reflective film formed on a pit side, and it considers as a signal side, and is created by forming a protective coat etc. on a signal side further.
[0007] Moreover, a disk substrate is formed considering the transparence polycarbonate resin with which light transmission nature has a pair mechanical property and a pair chemistry property highly, polyvinyl chloride resin, or acrylic resin as an ingredient. Moreover, the reflective film is film with the high reflection factor formed by vapor-depositing metals, such as aluminum MUNIUMU, and a reflection factor is made into about 80%. Furthermore, a protective coat is formed using transparence polycarbonate resin etc. like a disk substrate. The front face (namely, front face of an optical disk) of a protective coat has about 4% of small reflection factor. In the configuration of such an optical disk, substrate thickness is the distance from the front face of a protective coat to the reflective film.
[0008] The distinction approach of the following disk classes of having paid one's attention to the difference in such substrate thickness is learned. That is, in case the actuator of an optical pickup is operated and the

objective lens is brought close to an optical disk, it is the approach of distinguishing using the signal generated by making the sum signal based on the reflected light from an optical disk after [magnification] binary.
[0009] When bringing the objective lens close to an optical disk, when the focus of the laser beam for playback is together put on the surface of an optical disk, the reflected light with small reinforcement is first obtained with the small reflection factor mentioned above. Then, when the objective lens was brought further close to an optical disk and the focus of the laser beam for playback is united with the signal side of an optical disk, the reflected light with large reinforcement is obtained by the echo in respect of a signal. Since the time difference of the between at the time of these two kinds of reflected lights being obtained increases as the substrate thickness of an optical disk generally becomes large, it becomes possible [distinguishing the class of optical disk from the substrate thickness which has recognized and recognized the substrate thickness of an optical disk based on this time difference].
[0010] For example, as mentioned above, when large compared with the reference value which requires the time difference which it mentioned above by setting up the reference value for distinction beforehand, respectively since substrate thickness was 0.6mm / 1.2mm, in DVD/CD, it can distinguish that the optical disk with which it is equipped is CD. Moreover, when small compared with the reference value which requires the time difference mentioned above, it can distinguish that the optical disk with which it is equipped is DVD.
[0011]
[Problem(s) to be Solved by the Invention] However, an approach which was mentioned above has the fault of right distinction becoming impossible, when the response relation of the displacement rate of the direction of a focus of the actuator made according to the signal and the signal to cut for driving the sensibility of the direction of a focus of the actuator of an optical pickup, i.e., an actuator, varies above to some extent. Dispersion in the sensibility of the direction of a focus of the actuator of an optical pickup may originate in the temperature characteristic of actuation of components, such as dispersion between each equipment mass-produced, a change with time for every equipment, and an actuator, etc., and may be produced, and the difference between the maximum of sensibility and the minimum value may reach a twice as many abbreviation as this.
[0012] Dispersion becomes large also about the event of the focal location and the reflected light of an objective lens and the laser beam for playback being obtained, therefore dispersion becomes large also about the time difference detected as the real time as mentioned above, so that dispersion in the sensibility of the direction of a focus of an actuator becomes large. When dispersion in such time difference becomes large above to some extent and the time difference over the reference value for the distinction in an above-mentioned approach is detected, an error arises in the result of distinction and fear is in it.
[0013] A possibility that the error of such distinction may arise is abolished, or as an approach of decreasing the extent, although it is possible to suppress dispersion in the sensibility of the direction of a focus of an actuator, to measure sensibility beforehand about each equipment and to memorize measured value for the predetermined storage means in equipment, etc., it reaches technically and implementation is difficult by the difficulty in respect of cost.
[0014] Therefore, the object of this invention is to offer the optical disk unit which can distinguish the class of optical disk correctly, also when the sensibility of the direction of a focus of the actuator of an optical pickup has dispersion.
[0015]
[Means for Solving the Problem] In an optical disk unit with possible invention of claim 1 performing the record or playback to two or more kinds of optical disks with which substrate thickness differs mutually The 1st time difference detection means which detects the time difference between the predetermined signal parts in the sum signal generated based on the reflected light from an optical disk, It has the 2nd time difference detection means which detects time difference with a negative side the forward side of the S character signal part in the focal error signal generated based on the reflected light from an optical disk. In case actuation which approaches or estranges the objective lens in an optical pickup to an optical disk is performed It is the optical disk unit characterized by performing normalization processing which normalizes the output of the 1st time difference detection means using the output of the 2nd time difference detection means, and distinguishing the class of optical disk based on the result of normalization processing.
[0016] According to the above invention, the normalization processing result from which the effect of dispersion in the sensibility of the direction of a focus of an actuator was removed can be obtained by

performing normalization processing which used the focal error signal to a sum signal.
[0017] Even if the sensibility of the direction of a focus of an actuator varies by distinguishing the class of optical disk based on such a normalization processing result, the class of optical disk can always be distinguished correctly.
[0018]
[Embodiment of the Invention] The overall configuration of the optical disk player which is one gestalt of implementation of this invention is explained with reference to drawing 1 . DVD and CD can be used as an optical disk 1 played. An optical disk 1 is rotated with a predetermined angular velocity by the spindle motor which is not illustrated. An optical pickup 2 is moved on the truck with which it should be reproduced on an optical disk 1 by the thread device which is not illustrated in which it operates according to the command of a controller 3.
[0019] A controller 3 performs motion control of each component of a spindle motor, and the laser power KONTORU circuit 4 mentioned later, the biaxial actuation circuit 5, the focal error signal binary-ized circuit 6 and sum signal magnification binary-ized circuit 7 grade and equipment other than the position control of an optical pickup 2. Moreover, a controller 3 has a signal-processing system for reproducing the data currently recorded on the optical disk 1 based on the output of an optical pickup 2. Furthermore, a controller 3 has a signal-processing system for distinguishing a disk class which is mentioned later based on the output of the focal error signal binary-ized circuit 6 and the sum signal magnification binary-ized circuit 7. By changing setting out of the signal-processing system for reproducing data based on the distinction result of such a disk class, it is made as [regenerate / the data corresponding to a record format of the optical disk with which it was equipped].
[0020] An optical pickup 2 is an optical pickup which has the optical system which can acquire a regenerative signal about all of CD/DVD. This optical pickup 2 has semiconductor laser 21, a beam splitter 22, a collimator lens 23, an objective lens 24, the biaxial actuator 25, and the optical detector 26. Semiconductor laser 21 emits light in record of proper power, and/or the laser beam for playback under control by the laser power control circuit 4. Wavelength of this laser beam is set to 650nm at the time of 780nm and DVD playback for example, at the time of CD playback. A beam splitter 22 carries out incidence of the reflected light from an optical disk 1 to the optical detector 26 while it bends the laser beam which carried out outgoing radiation from semiconductor laser 21 and making it go in the direction of an optical disk 1.
[0021] A collimator lens 23 changes the divergence light from semiconductor laser 21 into parallel light, and let this parallel light be the spot of the predetermined location on an optical disk 1 with an objective lens 24. In order to cancel a focal error and a tracking error, it is made to change an objective lens 24 with the biaxial actuator 25 by the direction of a focus, and the direction of the diameter of a disk. The biaxial actuator 25 is driven by the biaxial actuation circuit 5.
[0022] On the other hand, the quadrisection photodetector is used as an optical detector 26. The reflected light from an optical disk 1 is received, and four signals A, B, C, and D are generated. Signals A, B, C, and D are supplied to the focal error signal binary-ized circuit 6 and the sum signal magnification binary-ized circuit 7. By performing the predetermined operation based on Signals A, B, C, and D, the focal error signal binary-ized circuit 6 generates a focal error signal, it makes binary the generated focal error signal with reference to a predetermined threshold, generates binary-ized focus error signal FCMPH and FCMPL, and supplies them to a controller 3. Moreover, after the sum signal magnification binary-ized circuit 7 amplifies the sum signal which generated and generated the sum signal based on Signals A, B, C, and D, it is made binary, generates the binary-ized sum signal PICMP, and it supplies it to a controller 3.
[0023] The I/O section in a controller 3 (I/O section) measures the time difference between the start edges of the binary-ized sum signal PICMP according to a predetermined algorithm. That is, since the start edge of PICMP has what is produced by echo in the front face of an optical disk, and the thing to produce by the echo in respect of the signal of an optical disk, the I/O section in a controller 3 measures the time difference between these two start edges, so that it may mention later. Moreover, the I/O section in a controller 3 also measures the time difference between the start edges between them about binary-ized focus error signal FCMPH and FCMPL. Based on the measurement value by the above time difference measurement, the class (any of DVD/CD are they?) of optical disk is distinguished so that it may mention later.
[0024] Moreover, servo actuation is controlled based on the tracking error signal later mentioned in binary-ized focus error signal FCMPH and FCMPL, and a list. That is, a servo control signal is generated based on these

signals, and D/A converter 8 is supplied. D/A converter 8 carries out D/A conversion of the signal supplied, and supplies it to the biaxial actuation circuit 5. Based on the output of D/A converter 8, the biaxial actuation circuit 5 drives the biaxial actuator 25.
[0025] the case where an optical disk 1 is DVD although the graphic display of a configuration of starting generation of a tracking error signal was omitted in drawing 1 -- DPD (Differential Phase Detection) -- a tracking error signal is generated by law etc. based on Signals A, B, C, and D. Moreover, when an optical disk 1 is CD, a tracking error signal is generated for example, by the push pull method etc.
[0026] Hereafter, the sum signal magnification binary-ized circuit 7 is explained to a detail. An example of the sum signal magnification binary-ized circuit 7 is shown in drawing 2 . The resistance indicated in drawing 2 shows an example, and there is what is limited to these values. [no] Moreover, VC in drawing is operating voltage which consists of one half of electrical-potential-difference values of supply voltage Vcc. The signals which the optical detector 26 consists of a quadrisection light sensing portion which consists of four light sensing portions A, B, C, and D as mentioned above, and each light sensing portions A, B, C, and D generate are the above-mentioned signals A, B, C, and D, respectively (that is, the notation of a light sensing portion and the notation of the signal which a light sensing portion generates are made the same).
[0027] Signals A, B, C, and D are added by the summing amplifier 71, and are reversed with the reversal amplifier 72. Therefore, the output of the reversal amplifier 72 serves as a reversed sum signal. The high gain amplifier 73 is formed in the latter part of the reversal amplifier 72. In the example shown in drawing 2 , the amplification factor of the high gain amplifier 73 is made into 56 times.
[0028] With the high amplification factor of the high gain amplifier 73, not only the signal based on the reflected light obtained from the signal side of an optical disk 1 but the signal based on the reflected light reflected on the front face of an optical disk 1 can fully be amplified. The comparator 74 is formed in the latter part of the high gain amplifier 73. a comparator 74 -- the output of the high gain amplifier 73 -- binary-izing -- and it is reversed and the binary-ized sum signal PICMP is generated.
[0029] On the other hand, the focal error signal binary-ized circuit 6 consists of a focal error signal calculation circuit 61 and the focal error signal binary-ized processing section. An example of the focal error signal calculation circuit 61 is shown in drawing 3 , and an example of the focal error signal binary-ized processing section is shown in drawing 4 . The resistance indicated in drawing 3 and drawing 4 is an example, and there is what is limited to these values. [no] The focal error signal calculation circuit 61 calculates and outputs focal error signal (A+C)-(B+D) based on the signals A, B, C, and D which the optical detector 26 generates. It is inputted into the focal error signal binary-ized processing section as this focal error signal shows to drawing 4 .
[0030] In a focal error signal, the signal (S character signal) based on the reflected light obtained from the signal side of an optical disk which has a bottom product part and a top part is included so that it may mention later. The focal error signal binary-ized processing section as shown in drawing 4 generates FCMPH and FCMPL which start corresponding to the bottom product part and top part of the S character signal based on the reflected light obtained from the signal side of an optical disk. In order to judge each start, a predetermined threshold is set up in the polar direction of +/-.
[0031] In drawing 4 , a focal error signal is supplied to the comparator 65 (it is hereafter written as the comparator 65 for H) for high-level which generates FCMPH, and 66 (comparator 66 for L) for comparators for low level which generate FCMPH through the buffer amplifier 62. Based on threshold FTHR inputted into the comparator 65 for H, and the comparator 66 for L through the buffer amplifier 63 from the exterior, the reference voltage value generated with the reversal amplifier 64 is supplied. That is, threshold FTHR is supplied to the comparator 66 for L as it is, and reversal etc. is processed by the inverting circuit 64 and threshold FTHR is supplied to the comparator 65 for H. However, you may make it supply the threshold from the outside to comparators 65 and 66 as reference voltage separately, respectively.
[0032] Next, the time difference measured in the I/O section in a controller 3 based on the binary-ized sum signal PICMP signal mentioned above is explained with reference to drawing 5 . first -- drawing 5 A -- 0.6mm of substrate thickness -- a dummy -- ********** -- DVD100 and CD200 of 1.2mm of substrate thickness were illustrated.
[0033] In the lower part of each disk, the laser beam for playback irradiated by each disk through an objective lens 24 and it was illustrated in drawing 5 A. An objective lens 24 and two laser beams for playback were illustrated for expressing the condition that the focal location of the laser beam for playback is on a signal side (102 in DVD100, 202 in CD200), when the focal location of the laser beam for playback was shown in a disk

front face (101 in DVD100, 201 in CD200) at the time of servo actuation. Therefore, the straight line which passes along two illustrated objective lenses 24 expresses an example of the locus of the objective lens 24 at the time of servo actuation.
[0034] Drawing 5 B shows an example of the sum signal based on the reflected light. Since the amount of reflected lights is large when the focal location of the laser beam for playback is on a signal side, a large peak is acquired (104 in DVD100, 204 in CD200). On the other hand, since the small reflected light arises also when the focal location of the laser beam for playback is on the surface of an optical disk, a small peak is acquired (103 in DVD100, 203 in CD200).
[0035] The signal (namely, output of the high gain amplifier 73 in drawing 2) acquired by amplifying such a sum signal is shown in drawing 5 C. Here, since the reversal amplifier 72 is formed in the preceding paragraph of the high gain amplifier 73, the polarity of drawing 5 C is set to drawing 5 B with reverse. In the part corresponding to the large peak 104 and 204, i.e., the peaks mentioned above, the saturation of signal strength shall arise (106 in DVD100, 206 in CD200), and the small peak 103 and 203, i.e., the peaks mentioned above, shall be amplified, and it shall have reinforcement sufficient for subsequent binary-ized processing (104 in DVD100, 204 in CD200).
[0036] The signal which made binary the amplified sum signal as shown in drawing 5 C by the binary-ized circuit 74 in drawing 2 is shown in drawing 5 D. Since reversal is also performed in the binary-ized circuit 74, let the polarity of drawing 5 D be reverse with drawing 5 C. By binary-ized processing, corresponding to a large peak, a pulse with wide width of face (108 in DVD100, 208 in CD200) generates, and a pulse with narrow width of face (107 in DVD100, 207 in CD200) generates corresponding to a small peak.
[0037] And the distinction using the difference in substrate thickness of a disk class is attained by measuring the real-time difference Ths between these two kinds of start edges of a pulse. that is, since the substrate thickness of CD200 is twice the substrate thickness of DVD100 as mentioned above, Ths measured about CD200 should serve as the twice as many abbreviation for Ths which resembles DVD100, sticks and is measured as this -- it comes out. So, with the common equipment currently used from the former, a reference value is set up beforehand and it is made as [distinguish / with reference to this reference value / CD/DVD based on the measurement value of Ths].
[0038] The following problems arise in the distinction approach of such CD/DVD. Dispersion arises [the measurement value of the real-time difference Ths to fixed substrate thickness] by dispersion in the sensibility of the direction of a focus of the biaxial actuator 25, i.e., dispersion, such as speed of the variation rate of the objective lens 24 to the driving signal which the biaxial actuation circuit 5 generates. When this dispersion becomes large above to some extent, it becomes impossible to distinguish CD/DVD based on the measurement value of Ths correctly. Dispersion in the sensibility of the biaxial actuator 25 originates in dispersion between each equipment mass-produced, the change with time for every equipment, the temperature characteristic, etc., and may be produced.
[0039] This point is explained with reference to drawing 6 . Drawing 6 is a histogram which shows an example of dispersion in the measurement value of Ths. An axis of abscissa is the measurement value of Ths, and an axis of ordinate is the frequency of each measurement value. The left-hand side of the dotted line of central length shows dispersion in the measurement value to DVD, and right-hand side shows dispersion in the measurement value to CD. Although the measurement value of Ths is distributed considering a value with average both as a core, it has lapped in the part which the part which takes the value which varied in the larger one of the measurement values to DVD, and the part which takes the value which varied in the smaller one among the measurement values to CD showed with the sign of 300 among drawing 6 . When the measurement value belonging to this part is obtained, there is a possibility of mistaking distinction of CD/DVD.
[0040] So, in this invention, the amount from which dispersion in the sensibility which normalized and mentioned Ths above was removed is computed, and it is made to distinguish CD/DVD based on the result of normalization. Since FCMPH and FCMPL are the signals which start corresponding to the bottom product part and top part of the S character signal based on the reflected light obtained from the signal side of an optical disk as mentioned above, Tfs measured as time difference between the start edges of FCMPH and FCMPL is influenced like Ths of dispersion in the sensibility of the direction of a focus of the biaxial actuator 25.
[0041] for this reason, the ratio obtained by breaking Ths by Tfs -- since the effect of dispersion in the sensibility of the direction of a focus of the biaxial actuator 25 negates each other in Ths/Tfs -- a ratio -- let Ths/Tfs be an amount with small dispersion. namely, -- as normalization processing -- a ratio -- the division

count which computes Ths/Tfs can be used.
[0042] for example, the variation rate of the direction of a focus -- since both Ths and Tfs become twice an average value also when a rate is 0.5 times the average rate by a certain factor -- a ratio -- the case where Ths/Tfs is made at a rate with the average variation rate of the direction of a focus, and abbreviation -- the same value is taken. the ratio obtained by normalization processing -- if it is made to distinguish CD/DVD based on Ths/Tfs, even if the sensibility of the direction of a focus of the biaxial actuator 25 varies, it will become possible to perform right distinction.
[0043] The measurement of Tfs based on the output of the focal error signal binary-ized circuit 6 mentioned above is more concretely explained with reference to drawing 7 . Although drawing 7 A-D was completely the same as that of drawing 5 A-D, in order to clarify a response with drawing 7 E-G, it was again indicated in drawing 7 . Drawing 7 E shows an example of a focal error signal (namely, output of the focal error signal calculation circuit 61). Here, the large S character signal (110 in DVD100, 210 in CD200) based on the reflected light in a signal side and the small S character signal (109 in DVD100, 209 in CD200) based on the reflected light on the front face of an optical disk are detected.
[0044] Based on such a focal error signal, FCMPH and FCMPL which the focal error signal binary-ized processing section which was mentioned above with reference to drawing 4 generates are shown in drawing 7 F and drawing 7 G, respectively. Since high gain amplifier is not formed in the focal error signal binary-ized processing section unlike the sum signal magnification binary-ized circuit (refer to drawing 2), the pulse in drawing 7 F (111 in DVD100, 211 in CD200) and the pulse in drawing 7 G (112 in DVD100, 212 in CD200) are generated by each only based on a large S character signal (110 210). And the time difference Tfs between the start edges of these pulses is measured.
[0045] the ratio obtained as a result of the normalization processing which did in this way and used Tfs as mentioned above -- Ths/Tfs serves as an amount with small dispersion, as shown in drawing 8 . drawing 8 -- a ratio -- it is the histogram which shows an example of dispersion in the value of Ths/Tfs. Unlike the histogram of Ths shown in drawing 6 , the part which takes a large value among the values of Ths/Tfs to DVD, and the part which takes a small value among the measurement values to CD have not lapped. Therefore, a possibility of originating in dispersion in the sensibility of the direction of a focus of the biaxial actuator 25, and mistaking distinction of CD/DVD is cancelable.
[0046] One gestalt of implementation of this invention mentioned above binary--ization-processes a focal error signal, and obtains Tfs as time difference of the start edge of the signal acquired by binary-ized processing. On the other hand, other operation gestalten of this invention that detects a peak and a bottom product, respectively, measures the time difference between them after amplifying the S character signal of a focal error signal, and obtained Tfs as this measured value are possible. Hereafter, other operation gestalten of this invention are explained.
[0047] First, other whole operation gestalt configurations of this invention are explained with reference to drawing 9 . The focal error signal amplifying circuit 600, the point that a controller 30 is formed instead of a controller 3, etc. differ from the whole 1 operation gestalt configuration of this invention indicated to drawing 1 instead of the focal error signal generation circuit 6. A controller 30 performs processing which is different in a controller 3 based on the output of the focal error signal amplifying circuit 600.
[0048] Moreover, in drawing 9 , the same sign was given to the same component as each component of drawing 1 . The focal error signal amplifying circuit 600 has amplifier (for example, high gain amplifier 73 grade mentioned above with reference to drawing 2) with the configuration (for example, focal error signal calculation circuit 61 grade mentioned above with reference to drawing 3) which computes a focal error signal as shown in drawing 3 .
[0049] Hereafter, the processing for distinguishing the disk class (CD/DVD) in other 1 operation gestalten of this invention is explained with reference to drawing 10 . Drawing 10 A-D is completely the same as that of drawing 5 A-D and drawing 7 A-D, and the measurement approach of Ths is the same as that of 1 operation gestalt of this invention etc. also in other 1 operation gestalten of this invention. Drawing 10 E shows an example of the focal error signal which the focal error signal calculation circuit which the focal error signal amplifying circuit 600 has outputs.
[0050] Moreover, drawing 10 E shows an example of amplified focal error signal FE (namely, final output of the focal error signal amplifying circuit 600). The part corresponding to the large S character signal (110 in DVD100, 210 in CD200) based on the reflected light from a signal side is saturated here, and the small S

character signal (109 in DVD100, 209 in CD200) based on the reflected light on the front face of an optical disk is amplified to sufficient magnitude (113 in DVD100, 213 in CD200). It is measured by approach which the peak of the S character signals 113 and 213 and the time difference of a bottom product which were amplified mention later, and a measurement value is set to Tfs.

[0051] Thus, the effect of dispersion in the sensibility of the direction of a focus of the biaxial actuator 25 is reflected like [Tfs obtained] 1 operation gestalt of this invention mentioned above. Therefore, normalization processing which used this Tfs is performed, and if the class of optical disk is distinguished based on the small amount of dispersion acquired as that result, also when the sensibility of the direction of a focus of the biaxial actuator 25 has dispersion, the class of optical disk can be distinguished to accuracy.

[0052] normalization processing more specifically breaks Ths by this Tfs -- a ratio -- it can carry out by computing Ths/Tfs. drawing 11 -- a ratio -- it is the histogram which shows an example of dispersion in the value of Ths/Tfs. Drawing 11 shows that dispersion in the value of Ths/Tfs is improved compared with dispersion in the value of Ths (refer to drawing 6) like drawing 8 in 1 operation gestalt of this invention. That is, the part which takes a large value among the values of Ths/Tfs to DVD, and the part which takes a small value among the measurement values to CD have not lapped. Therefore, a possibility of originating in dispersion in the sensibility of the direction of a focus of the biaxial actuator 25, and mistaking distinction of CD/DVD is cancelable.

[0053] The concrete approach for measuring Tfs as the peak of the S character signals 113 or 213 and time difference of a bottom product (referring to drawing 10 E) is explained with reference to the enlarged drawing of the flow chart of drawing 12 , and the S character signals 113 or 213 of drawing 13 . In drawing 13 , each point on a curve shows the sampling point. Such a sampling is performed with a predetermined sampling period by the predetermined configuration in a controller 3. And B is a sampling point corresponding to a bottom product, and T is a sampling point corresponding to the top.

[0054] Ten steps to step S1 - step S10 are contained in the flow chart of drawing 12 . Among this, it is the procedure in which step S1 - step S4 detect a bottom product, and step S6 - step S8 are the procedures of detecting the top. And according to detection of a bottom product/top, start/stop of the timer which measures a peak and the time difference of a bottom product is carried out.

[0055] It is set up with P= 0 as step S1 after procedure initiation, and the value of P is initialized. This P is a variable for storing the thing in front of 1 sampling clock among the values of amplified focal error signal FE (refer to drawing 10 E). And the newest sampling value of FE is incorporated to Variable D as step S2. Furthermore, the value of P is compared with the value of D as step S3. Since it can judge that the value of P is a bottom product value (value of B in drawing 13) when it becomes P<D, a timer is started at this event (step S5). On the other hand, since the value of P can judge that the lower right which results in a bottom product is included in the curvilinear part of ** when it is not P<D, it shifts to step S4, and the value of D at that time is set as P, it shifts to step S2 further, and the new value of FE is incorporated to D. Therefore, the loop formation which consists of step S2 - S4 will be repeated until it becomes P<D at step S3.

[0056] After a timer is started in step S5, it shifts to step S6 and the new value of FE is incorporated to D. And the value of P is compared with the value of D as step S7. Since it can judge that the value of P is a top value (value of T in drawing 13) when it becomes P>D, a timer is made to stop at this event (step S9). On the other hand, since it can judge that the value of P is included in the curvilinear part upward slanting to the right which results in the top when it is not P>D, it shifts to step S8, and the value of D at that time is set as P, it shifts to step S6 further, and the new value of FE is incorporated to D. Therefore, the loop formation which consists of steps S6-S8 will be repeated until it becomes P<D at step S7.

[0057] After a timer is made to stop in step S9, it shifts to step S10 and the measurement time amount Tfs held at the timer is read. And a procedure is completed.

[0058] The inside of the 1 gestalt of implementation of this invention mentioned above uses the optical pickup which has the optical system which can generate a regenerative signal from both CD and DVD. On the other hand, this invention is applicable also to the optical disk unit which has a separate optical pickup corresponding to each of CD and DVD. In this case, what is necessary is to distinguish the class of optical disk with which it was equipped by the distinction approach which starts this invention, for example using the optical pickup corresponding to DVD, and just to choose the optical pickup which should be used while performing setting out of the processor concerning playback of data etc. according to a distinction result. However, the optical pickup used for distinction of the class of optical disk needs to be what can obtain the sum signal and the focal error

signal which have a precision required in order to perform the distinction approach concerning this invention from any optical disk.
[0059] Moreover, it has the separate optical system corresponding to each of CD and DVD, and this invention can be applied also to the optical disk unit which changes and uses those optical system. In this case, what is necessary is to distinguish the class of optical disk with which it was equipped by the distinction approach which starts this invention, for example using the optical system corresponding to DVD, and just to make it choose the optical system which should be used with setting out of the processor concerning playback of data etc. according to a distinction result. However, the optical system used for distinction of the class of optical disk needs to be what can obtain the sum signal and the focal error signal which have a precision required in order to perform the distinction approach concerning this invention from any optical disk.
[0060] Although one gestalt of implementation of this invention mentioned above on the other hand is applied to the optical disk unit which has the function which reproduces both CD and DVD for this invention, it can apply this invention also to the optical disk unit which has the function to perform record and/or playback about two or more kinds of optical recording media which have different substrate thickness.
[0061] For example, it is applicable to the optical disk unit which has the function which plays both the optical disk called the so-called DVD family which has 0.6mm substrate thickness, and the optical disk called the so-called CD family which has 1.2mm substrate thickness. DVD-RAM (DVD-Random Access Memory) in which DVD-ROM (DVD-Read Only Memory) mainly used for applications, such as data storage for computers, DVD-R (DVD-Recordable) in which postscript record is possible, and rewriting are possible as a DVD family etc. -- it is. Moreover, as a CD family, there are CD-ROM (CD-Read Only Memory) mainly used for applications, such as data storage for computers, CD-R (CD-Read Recordable) whose postscript record is enabled, CD-RAM (CD-Random Access Memory) whose rewriting is enabled.
[0062] Moreover, this invention can consider application and deformation various in the range which does not deviate from the summary of this invention, without being limited to the gestalt of operation mentioned above.
[0063]
[Effect of the Invention] As mentioned above, this invention normalizes Ths measured as a real-time difference with the event of the reflected light from the event of the reflected light from an optical disk front face being detected and a signal side being detected using the time difference Tfs measured based on a focal error signal, and distinguishes the class of optical disk with which equipment was equipped based on the result of the normalization.
[0064] the ratio obtained as a result of normalization processing since Ths and Tfs are the measurement values similarly influenced of dispersion in the sensibility of the direction of a focus of an actuator -- since the effect of dispersion in the sensibility of the direction of a focus of an actuator negates each other in Ths/Tfs etc. -- a ratio -- Ths/Tfs etc. serves as a small amount of dispersion. For this reason, dispersion in the sensibility of the direction of a focus of an actuator can be prevented from influencing the correctness of distinction of an optical disk.
[0065] For example, even if it originates in the temperature characteristic of actuation of components, such as dispersion between each equipment mass-produced, a change with time for every equipment, and an actuator, etc. and dispersion in the sensibility of the direction of a focus of an actuator arises, CD/DVD etc. can prevent that an error arises in distinction of the class of optical disk which can be set as the object of record and/or playback. For this reason, the class of optical disk can always be distinguished to accuracy.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is a block diagram for explaining the whole 1 operation gestalt configuration of this invention.
[Drawing 2] It is a block diagram for explaining the configuration of the part in the 1 gestalt of implementation of this invention.
[Drawing 3] It is a block diagram for explaining the configuration of other parts in the 1 gestalt of implementation of this invention.
[Drawing 4] It is a block diagram for explaining the configuration of the part of further others in the 1 gestalt of implementation of this invention.
[Drawing 5] It is approximate line drawing for explaining distinction of an optical disk in a common optical disk unit.
[Drawing 6] It is a histogram for explaining the trouble in distinction of an optical disk in a common optical disk unit.
[Drawing 7] It is approximate line drawing for explaining distinction of an optical disk in 1 operation gestalt of this invention.
[Drawing 8] It is a histogram for explaining the accuracy of distinction of the optical disk in 1 operation gestalt of this invention.
[Drawing 9] It is a block diagram for explaining other whole gestalt configurations of operation of this invention.
[Drawing 10] It is approximate line drawing for explaining distinction of an optical disk in other gestalten of implementation of this invention.
[Drawing 11] It is a histogram for explaining the accuracy of distinction of the optical disk in other operation gestalten of this invention.
[Drawing 12] It is a flow chart for explaining the measurement approach of Tfs in other gestalten of implementation of this invention.
[Drawing 13] It is approximate line drawing for explaining the measurement approach of Tfs in other gestalten of implementation of this invention.
[Description of Notations]
1 [... A biaxial actuator, 3 / ... A controller, 6 / ... A focal error signal binary-ized circuit 7 / ... A sum signal magnification binary-ized circuit, 30 / ... A controller, 600 / ... Focal error signal amplifying circuit] ... An optical disk, 2 ... An optical pickup, 24 ... An objective lens, 25

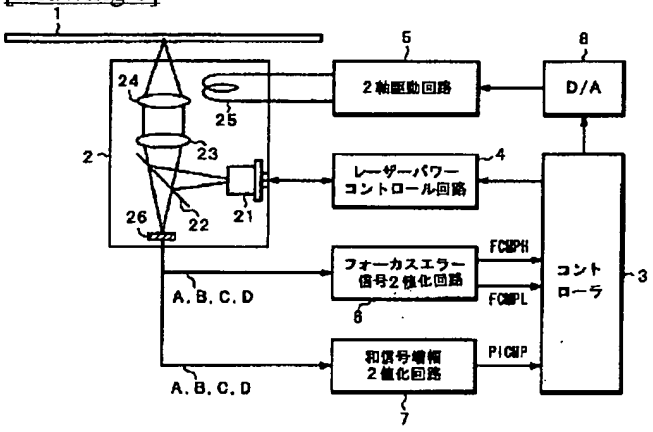
[Translation done.]

* NOTICES *

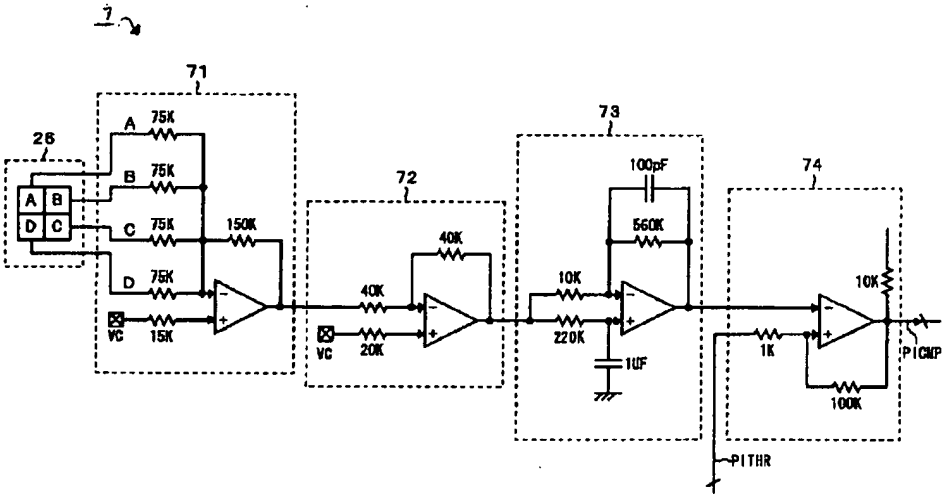
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

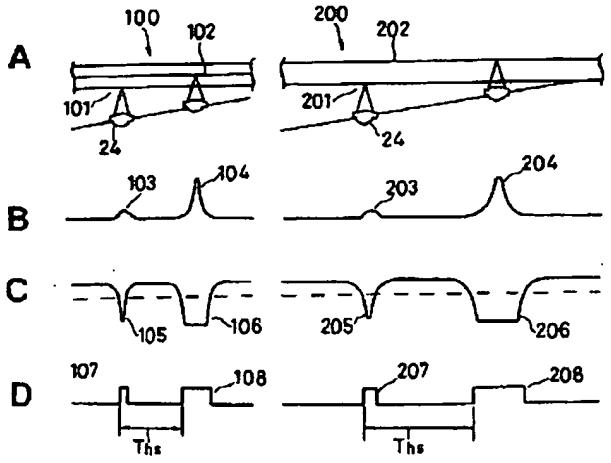
[Drawing 1]



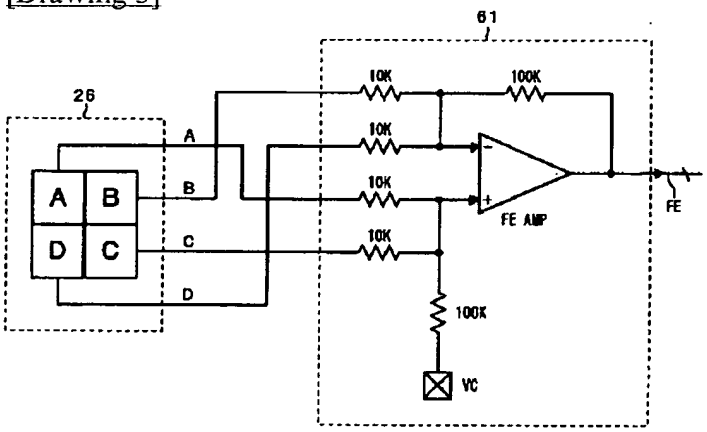
[Drawing 2]



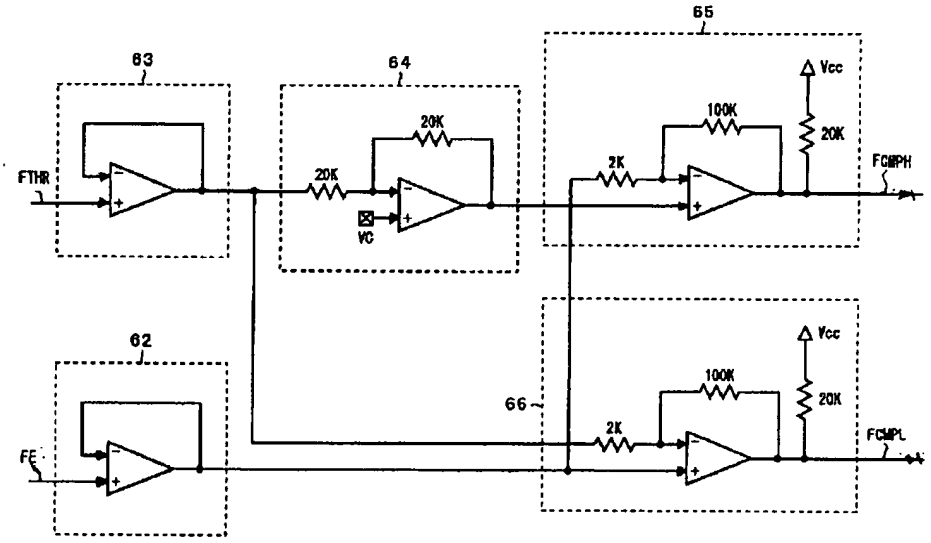
[Drawing 5]



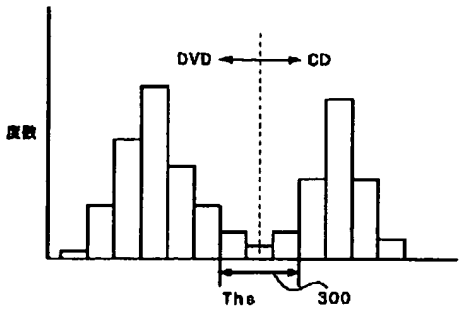
[Drawing 3]



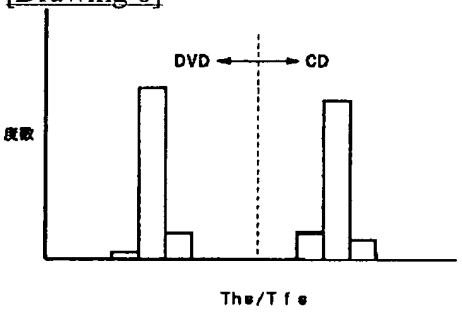
[Drawing 4]



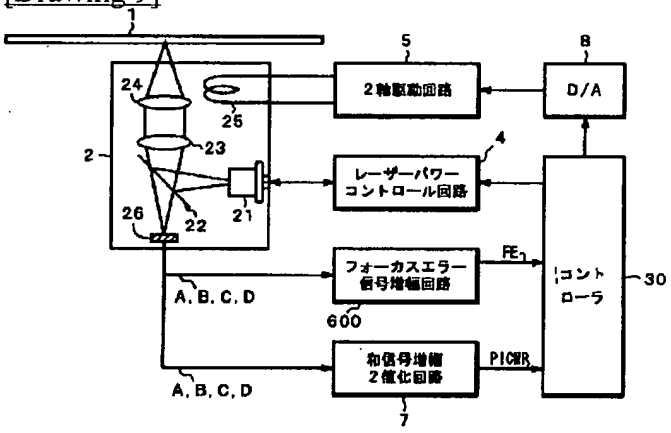
[Drawing 6]



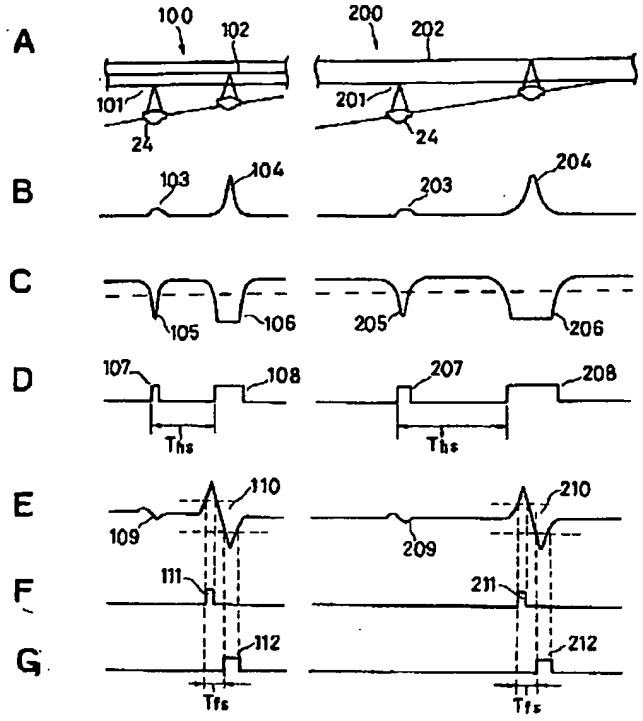
[Drawing 8]



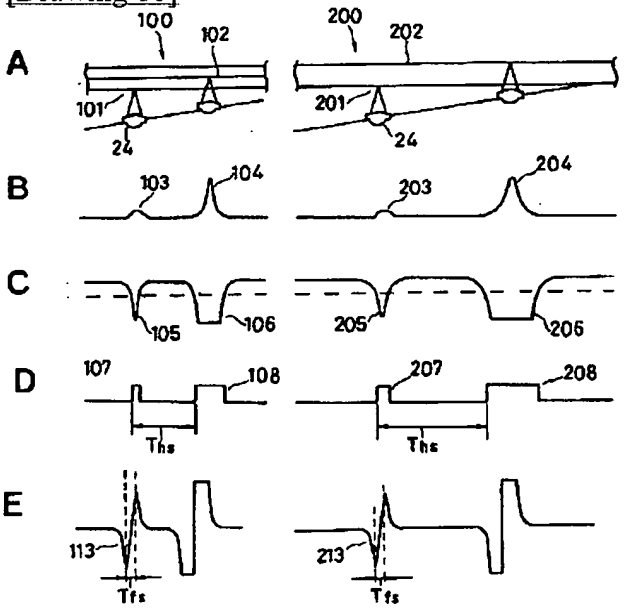
[Drawing 9]



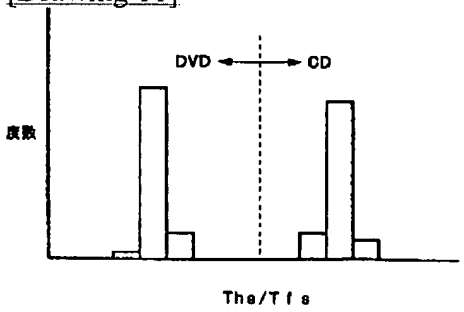
[Drawing 7]



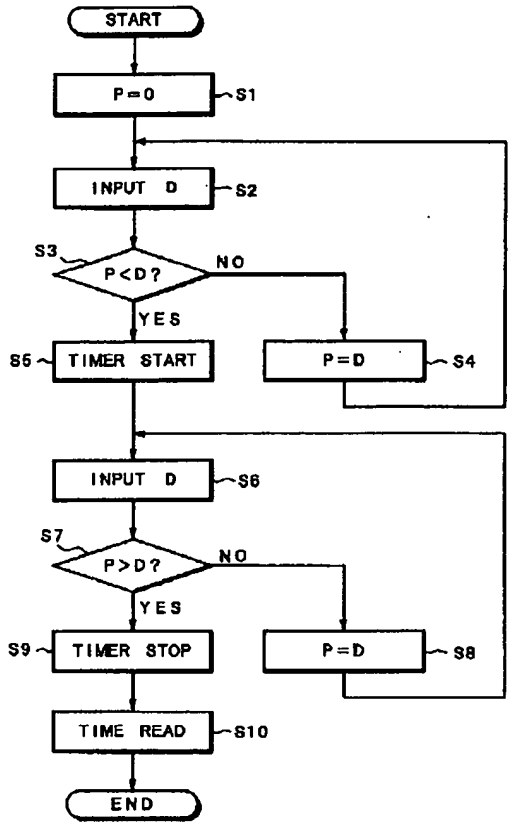
[Drawing 10]



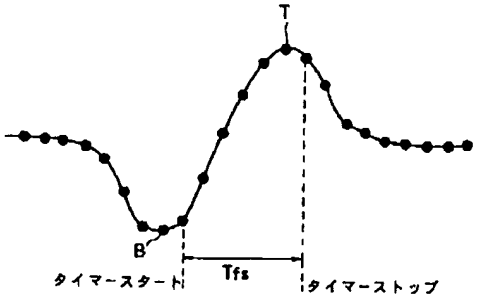
[Drawing 11]



[Drawing 12]



[Drawing 13]



[Translation done.]

An optical disc apparatus comprising:

a laser;

a focusing lens for focusing light emitted from the laser onto an optical disc;

a sensor for generating a signal corresponding to laser emitted light reflected from the optical disc;

a control circuit for determining a type of optical disc by calculating a result; and

a memory, the memory comprising:

a first predefined threshold used to determine when a focal point of the focusing lens is within a first layer of the optical disc according to the generated signal;

a second predefined threshold used to determine when a focal point of the focusing lens is within a second layer of the optical disc according to the generated signal; and

a predefined third value indicating a result range enabling optical disc type determination;

wherein ~~a~~ the result is a ratio of a second duration required for the focal point to move from the first layer to the second layer and a first duration where the generated signal exceeds the first predefined threshold.